Space Weather Technical Forecast

Issued on Sunday, 20 August 2023 at 01:11 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Slightly increasing Chance of Minor R1 Radio Blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity measured by GOES16 has remained Low, with the peak flare of the UTC day of Saturday 19 August a C5.8 event from AR3406 in the far southwest at 19/0648UTC. Background X-ray flux remains subdued at high B-class levels.

There are currently up to nine sunspot regions on the visible disc, with one unnumbered near the southeastern limb. The main changes in the period were tied to intermediate and trailer development in two of the larger and more complex regions: AR3403 in the northwest and AR3407 in the south-centre disc, while AR3406 in the southwest showed changeable spots come and go. Other groups on the disc were generally magnetically simpler and more stable or else fading.

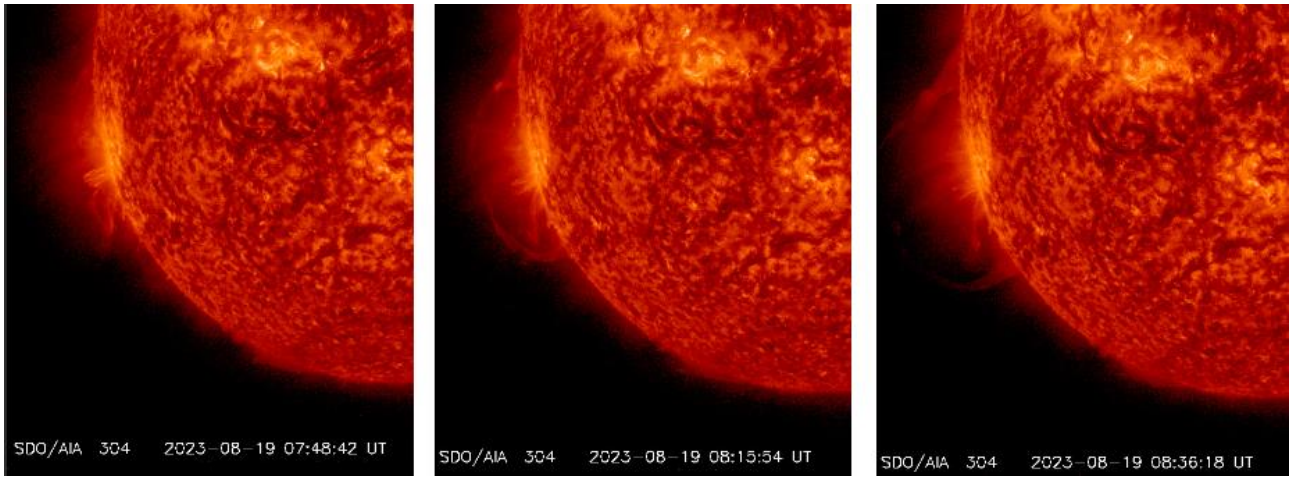

Figure 0: AIA304 time sequence showing a large, narrowly far-sided prominence lift-off between 19/0730 and 0900UTC. This CME has been analysed and has no effect on Earth.

There were a few progenitors of Coronal Mass Ejections (CMEs) visible in the past 24 hours. The first of these was a very large roughly 20-degree solar latitude-spanning prominence eruption from just behind eastern solar horizon, taking place between 19/0730 and 0900UTC. This produced a clear CME in coronagraphs that has been determined to have no Earth-directed component. This was followed a little later in the day by an east limb dimming and CME near solar the northern end of the previous prominence - around the solar equator at 19/1500UTC. This has yet to be analysed but is not expected to affect Earth. Both of these events could perhaps be suggestions that Ex-AR3386 may have survived in some form at this location - something of relevance for the X-ray forecast - and eventually the geomagnetic and solar radiation forecast should it survive for any length of time.

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The final main noted event was a filament eruption from the vicinity of AR3403 in the northwest at 19/1800UTC. Imagery for this is pending, however - tentatively - no Earth-directed CMEs feature in the forecast.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR and ACE at L1, suggests Earth is transiting a sector of space characterised by a negative polarity fast wind. This had been thought to be due to CH35/-, but a resurgence within the same sector later in the UTC day may represent either reconnection or else transfer to an unidentified hole of the same polarity. The phi angle was accordingly almost exclusively negative (towards the Sun).

Solar wind speeds initially declined from Elevated levels and 500km/s to reach a midday nadir of around 425 before increasing in the UTC afternoon and evening to recover almost all their lost ground and reach 475km/s. The solar wind density showed a similar undulating pattern - from 10ppcc to single figures and back again before a more decided fall at the very end of the 24 hours. The IMF showed a change in character from a flat trend below 4nT until the UTC afternoon, whereupon a steady rise to 9nT commenced, again moderating slightly at the close of the day. The north-south component, Bz, ranged between +7 and -6nT, with a slight positive bias overall, but not spending protracted periods either co- or anti-aligned with Earth's field.

The net result of the above solar wind measures was for provisionally mainly Quiet geomagnetic activity, peaking at occasional Kp '2+'.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux remained at Background levels.

GOES16 high energy (greater than 2MeV) electron flux ranged to Moderate to Normal Background levels, with the associated 24-hour fluence well below the Active level, with an observed value of 2.71e6 integrated pfu at 20/0001UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Activity is most likely to remain Low, but perhaps show an uptick with the arrival of a far-sided group (that was highly active as it left the Earth-facing side) into the new UTC week.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs feature in the forecast, and the sole fast wind is the incumbent, but waning influence of CH35/-. Chances of isolated Unsettled intervals should fade later in the UTC weekend to otherwise leave a largely Quiet remainder of the forecast into the new UTC working week.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is expected to remain at Background levels.

High energy electron flux (greater than 2MeV) may show a slight increase as CH35/- wanes, with diurnal peaks in Moderate becoming more likely into the new UTC week. The associated 24-hour fluence is expected to persist comfortably below Active (1e8 integrated pfu).

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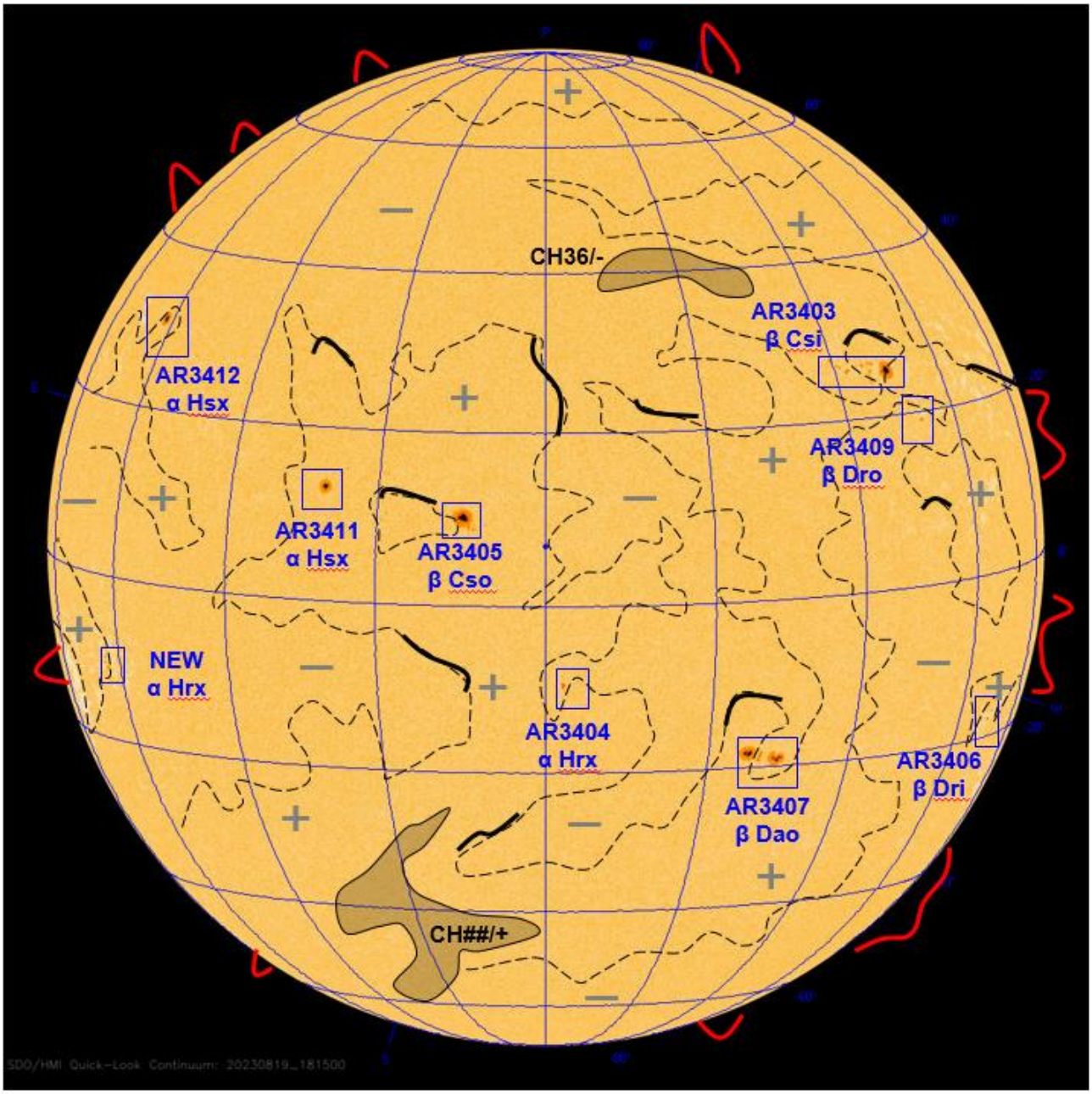
Figure 1. Solar Analysis Valid 19/1815UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs currently feature in the forecast period.

The sole fast wind expected in the period is the incumbent CH35/-. While the recent resurgence was not expected within the current negative sector, this has yet to result in activity beyond Unsettled, and the previously-established waning trend is likely to very soon be reinstated.

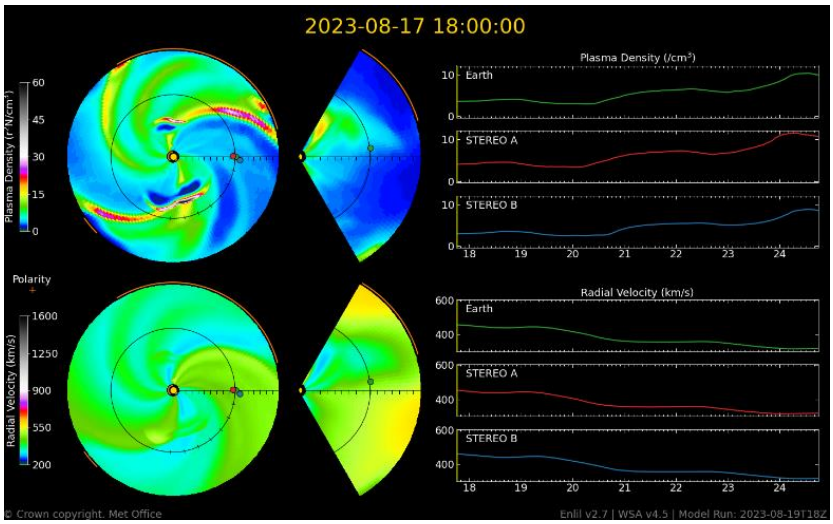
The chances of isolated Unsettled intervals should fade later in the UTC weekend to otherwise leave a largely Quiet remainder of the forecast into the new UTC working week.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: Latest available MOSWOC Enlil run (labelled 18Z), showing accepted gradual exit from the current fast wind from CH35/-.



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Radio Blackouts - X-Ray Flares:

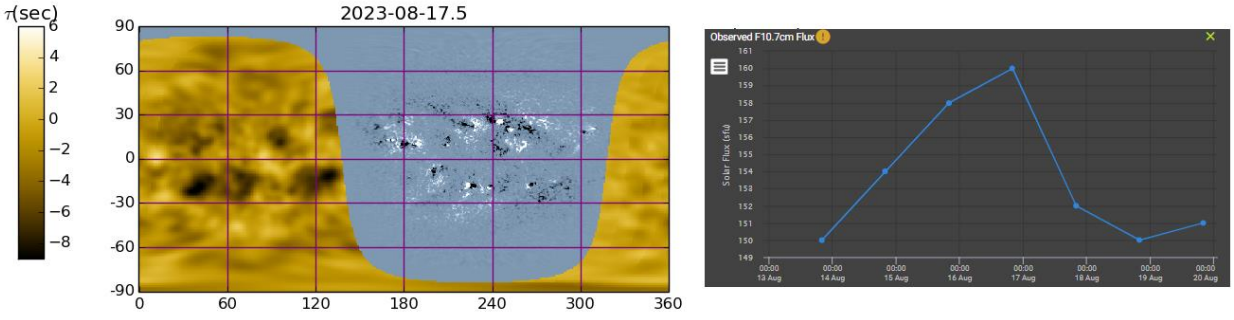
Solar activity has remained Low during the past 24 hours, however the 10.7cm Penticton flux value is now rallying about its Friday low of 150sfu (from a midweek high of 160). This may be in part to flux arriving over the eastern solar horizon, which is likely to dictate a forecast uptick in activity into the new UTC week.

The eastern solar horizon will shortly reveal the Carrington location for the previously active Ex-3386 (in the northern hemisphere) of roughly a fortnight ago. It is possible that a survival here is part of the cause of the witnessed instability and CMEs released from its vicinity in the past 24 hours. The unnumbered region (Dsi/Beta) near the southeast limb will become easier to analyse as it rotates into clear view in the coming days but presents a fairly strong signature on EUV imagery - this may correspond to Ex-3380, another previously active group.

While neither is guaranteed to show its former activity, given the largely quiet frontside, these additions are considered likely to increase the risk of M-class flares counteracting more minor western horizon losses in the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	25	30	30	30
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: (Left) whole Sun in cylindrical projection, showing a possible upcoming large active region near Carrington Longitude 090 degrees – that near 120 corresponds to the new unnumbered region on the current southeast disc. Also shown (right) is the past week in Penticton 10.7cm flux showing a slowing of the descent from midweek, with a reversal now possible given the oncoming group(s).



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Solar Radiation Storms - (High Energy Protons):

High energy (greater than 10MeV) proton flux observed by GOES16 is expected to remain at Background levels.

There persists an ongoing and very gradually increasing Slight Chance of proton flux increases from any significant flares, perhaps most likely from the western solar hemisphere, however these are considered very unlikely to reach S1 Minor Solar Radiation Storm levels.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	2	2	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux remains mainly within Normal Background levels. A degree of recovery in flux at GEO is expected later in the current UTC weekend as the fast wind from CH35/- wanes, however the limited strength of the current enhancement along with persistence and the latest MOSWOC REFM forecast all suggest that this will prove insufficient to generated Active 24-hour integrated fluence.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	10	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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